CLAIMS

What is claimed is:

1. Method of fabricating an electrical contact structure, comprising:

configuring a flexible elongate member to have a springable shape, said elongate member having a length;

selecting an overcoat material for its structural characteristics; and

applying the overcoat material onto the elongate member.

2. Method, according to claim 1, wherein:

the resulting contact structure exhibits both elasticity and plasticity.

3. Method, according to claim 1, wherein:

the elongate member serves as a falsework for the resulting resilient electrical contact structure; and

the overcoat material serves as a superstructure for the resulting resilient electrical contact structure.

4. Method, according to claim 1, further comprising:

leaving the elongate member in place after applying the overcoat.

5. Method, according to claim 1, further comprising:

at least partially removing the elongate member after applying the overcoat.

6. Method, according to claim 5, further comprising:

fully removing the elongate member after applying the

overcoat material.

7. Method, according to claim 1,

wherein the elongate member is formed of a first material having a melting temperature; and

further comprising:

prior to applying the overcoat material, coating the elongate member with a second material which is dissimilar from the first material and which is capable of forming an alloy with the first material, said alloy having a lower melting temperature than the melting temperature of the first material.

8. Method, according to claim 6, further comprising:

after applying the overcoat, heating the resulting resilient contact structure to form said alloy.

9. Method, according to claim 7, wherein the elongate member is a gold wire, and further comprising:

prior to applying the overcoat material, applying a layer of tin over the gold wire.

10. Method, according to claim 1, wherein:

the overcoat material has a set of structural properties; and

the resulting resilient electrical contact structure has a resilience which is determined primarily by the structural properties of the overcoat material.

11. Method, according to claim 1, wherein:

the elongate member has a set of physical properties; and

the resulting electrical contact structure has a

compliance which is determined by the structural properties of the overcoat and the physical properties of the elongate member.

12. Method, according to claim 1, wherein:
the overcoat material is applied to the elongate member by plating.

13. Method, according to claim 12, further comprising:
while plating the elongate member, applying heat to create a thermal gradient along the length of the elongate member.

14. Method, according to claim 12, further comprising:
causing a thickness of the overcoat material to be greater at a one end of the elongate member than at an opposite end of the elongate member.

15. Method, according to claim 1, further comprising:
prior to configuring the elongate member to have a springable shape, bonding a proximal end of the elongate member to a contact area on a substrate.

16. Method, according to claim 15, wherein:
the proximal end of the elongate member is bonded to the contact area with a wirebonder.

17. Method, according to claim 15, further comprising:
applying the overcoat material along the length of the elongate member and over the contact area.

18. Method, according to claim 17, wherein:

the overcoat material is continuous over the contact area and along the length of the elongate member.

19. Method, according to claim 15, further comprising:

after configuring the elongate member to have a springable shape, severing the elongate member to have a distal end.

20. Method, according to claim 19, further comprising:

severing the elongate member with an electrical discharge from an electrode.

21. Method, according to claim 20, further comprising:

while severing the elongate member with the electrical discharge, illuminating at least one of the elongate member and the electrode with ultraviolet light.

22. Method, according to claim 19, further comprising:

severing the elongate member with a tool.

23. Method, according to claim 1, further comprising:

while configuring the elongate member, applying ultrasonic vibrations to the elongate member.

24. Method, according to claim 1, wherein:

the overcoat material is electrically conductive.

25. Method, according to claim 1, wherein:

the overcoat material comprises multiple layers of material; and

at least one layer of the overcoat is electrically conductive.

26. Method, according to claim 1, wherein:

the overcoat is applied by a technique selected from a group consisting of wet electrochemical techniques, including electrolytic or electroless aqueous solution plating of metals; electroplating, chemical vapor deposition (CVD), physical vapor deposition (PVD), and any process that causes deposition of materials through decomposition or reaction of gaseous, liquid or solid precursors.

27. Method, according to claim 1, further comprising:

attaching a contact pad at a free end of the elongate member.

28. Method, according to claim 27, wherein:

the contact pad is attached to the one end of the elongate member prior to applying the overcoat material.

29. Method, according to claim 27, wherein:

the contact pad is attached to the one end of the elongate member after applying the overcoat material; and

further comprising:

after attaching the contact pad, applying an additional overcoat material.

30. Method, according to claim 27, further comprising:

forming a desired topography on a surface of the contact pad.

31. Method, according to claim 1, further comprising:

imparting a desired topography to a free end of the resulting contact structure.

32. Method of electrically interconnecting two electronic components, comprising:

bonding a proximal end of a flexible wire to a contact area on a surface of a first electronic component;

configuring the wire to have a springable shape;

severing the wire to have a distal end;

overcoating the wire and the contact area with an electrically conductive, resilient material, thereby forming a freestanding resilient contact structure mounted by a proximal end to the first electronic component and having a distal end; and

contacting a contact area on a second electronic component with the distal end of the resilient contact structure.

33. Method, according to claim 32, wherein:

the freestanding resilient contact structure exhibits both plasticity and elasticity.

34. Method, according to claim 32, further comprising:

attaching the distal end of the freestanding resilient contact structure to the second electronic component with a conductive material selected from the group consisting of solder and conductive epoxy.

35. Method, according to claim 32, further comprising:

prior to contacting the contact area on the second electronic component, mounting a contact pad to the distal end of the flexible wire.

36. Method of fabricating an interposer, comprising:

providing an interposer substrate having holes

extending therethrough;

providing a sacrificial substrate;

fabricating resilient contact structures on the sacrificial substrate;

causing the resilient contact structures to extend through the holes and to be suspended in the holes; and

removing the sacrificial substrate.

37. Method, according to claim 36, further comprising:

causing the resilient contact structures to be suspended within the holes of the interposer substrate with an elastomeric material.

38. Method, according to claim 35, further comprising:

soldering the resilient contact structures within the holes in the interposer substrate.

39. Method of mounting a plurality of contact structures to an electronic component, comprising:

fabricating a plurality of electrical contact structures on a sacrificial substrate, each of the electrical contact structures having a tip extending from the sacrificial substrate; and

bringing the sacrificial substrate into proximity with an electronic component so that the tips of the electrical contact structures contact the electronic component;

in a single step, mounting the electrical contact structures by their tips to the electronic component; and

after mounting the electrical contact structures to the electronic component, removing the sacrificial substrate.

40. Method, according to claim 39, further comprising:

after removing the sacrificial substrate, plating the

electrical contact structures.

41. Method of performing testing selected from the group consisting of test and burn-in on a semiconductor device, comprising:

mounting resilient contact structures directly to a semiconductor device;

urging the semiconductor device against a test board, said test board having contact areas, so that tips of the resilient contact structures are electrically connected to the contact areas on the test board;

performing testing on the semiconductor device;

subsequently mounting the semiconductor device to a system board, said system board having contact areas, so that the tips of the resilient contact structures are electrically connected to the contact areas on the system board.

42. Method, according to claim 41, further comprising:

permanently connecting the semiconductor device to the system board.

43. Method, according to claim 41, further comprising:

mounting the resilient contact structures to the semiconductor devices prior to singulating the semiconductor devices from a semiconductor wafer.

44. Method, according to claim 41, further comprising:

mounting the resilient contact structures to the semiconductor devices after singulating the semiconductor devices from a semiconductor wafer.

45. Method of temporarily connecting to a semiconductor device prior to permanently connecting to the semiconductor device, comprising:

mounting a plurality of electrical contact structures to a bare semiconductor device;

urging the semiconductor device against a first electronic component to effect a temporary connection between the semiconductor device and the first electronic component, with the electrical contact structures serving as an electrical interconnect between the semiconductor device and the first electronic component; and

using the same electrical contact structures mounted to the semiconductor device to effect a permanent connection between the semiconductor device and a second electronic component.

46. Method, according to claim 45, further comprising:

effecting the permanent connection by mechanically biasing the semiconductor device against the second electronic component.

47. Method, according to claim 45, further comprising:

permanently connecting the semiconductor device to the second electronic component.

48. Method, according to claim 45, wherein:

the electrical contact structures are resilient.

49. Method, according to claim 45, wherein:

the electrical contact structures are compliant.

50. Electrical connection between two electronic

components, comprising:

a conductive path consisting essentially of a metallic coating having at least one electrically-conductive layer, said metallic coating disposed on an elongate member, said coating extending between and interconnecting two electronic components.

51. Electrical connection, according to claim 50, wherein: the coating is a plating having at least one layer.

52. Electrical connection, according to claim 50, wherein: the elongate member is a wire.

53. Electrical connection, according to claim 52, wherein: the wire is electrically conductive.

54. Electrical connection, according to claim 52, wherein: the wire is a selected from a group consisting of gold and its alloys.

55. Electrical connection, according to claim 52, wherein: the wire is a selected from a group consisting of aluminum, copper, metals of the platinum group, lead, tin, indium, and their alloys;

56. Electrical connection, according to claim 50, wherein: the coating is selected from a material and the elongate member is configured so as to impart resiliency to the electrical connection.

57. Electrical connection, according to claim 50, wherein: the plating is a material selected from the group consisting of nickel and its alloys.

58. Electrical connection, according to claim 50, wherein:

the plating is a material selected from the group consisting of copper, cobalt, iron, and their alloys, and Ni/Fe/Co materials.

59. Electrical connection, according to claim 50, wherein:

the plating is a material selected from the group consisting of gold, silver, elements of the platinum group, noble or semi-noble metals and their alloys, tungsten, molybdenum, cobalt, zinc, tin, solder, and copper.

60. Electronic assembly, comprising:

a plurality of semiconductor dies mounted edge-to-edge, in close proximity to one another, on at least one side of a printed circuit board, each semiconductor die electrically connected to the printed circuit board by free-standing, resilient contact structures mounted to each of the semiconductor dies.

61. Electronic assembly, according to claim 60, wherein:

the semiconductor dies are memory devices.

62. Electronic assembly, according to claim 60, wherein:

the electronic assembly is a single in-line memory module (SIMM).

63. Electronic assembly, according to claim 60, wherein:

the resilient contact structures are compliant.

64. Electronic assembly, according to claim 60, wherein:

the semiconductor dies are mounted to both sides of the printed circuit board.

65. Electronic assembly, according to claim 60, wherein:

the freestanding resilient contact structures are formed by:

individually bonding wires to the semiconductor dies; and

overcoating the wires contemporaneously with one another.

66. Electronic assembly, according to claim 60, wherein:

the freestanding resilient contact structures are formed by:

individually bonding wires to a sacrificial substrate;

plating the wires; and

gang-transferring the plated wires to at least one of the semiconductor dies in a single step.

67. Electronic assembly, according to claim 66, further comprising:

after gang-transferring the plated wires, further plating the plated wires.

68. Electronic assembly, according to claim 60, further comprising:

a rigidizing material encapsulating at least a portion of the resilient contact structures.

69. Method of creating a superstructure on a falsework, comprising:

mounting at least one falsework on an electronic component;

disposing the substrate in a plating bath to form a superstructure on the at least one falsework.

70. Method, according to claim 69 further comprising:

prior to plating the at least one falsework, configuring each one of the at least one falseworks to have a springable shape.

71. Method, according to claim 69, further comprising:

while plating the at least one falsework, heating the electronic component.

72. Method, according to claim 71, wherein:

the resulting plating exhibits a thickness gradient of at least 1.5:1 from a thickest portion of the plating to a thinnest portion of the plating.

73. Method, according to claim 69, wherein:

at least two falseworks are mounted on the electronic component; and

the falseworks are free-standing, having a proximal end mounted to the substrate and a distal end; and

further comprising:

configuring the falseworks to have a greater spacing at their distal ends than at their proximal ends.

74. Method, according to claim 69, wherein:

the falseworks are free-standing, having a proximal end mounted to the substrate and a distal end; and

further comprising:

prior to plating the at least one falsework, applying a masking material to the distal ends of the falseworks; and

after plating the falseworks, removing the masking material.

75. Method, according to claim 74, further comprising:

after removing the masking material, further plating the falseworks.

76. Method, according to claim 69, further comprising:
after forming the superstructure on the falsework, removing a portion of the superstructure to expose the falsework.

77. Method, according to claim 69, further comprising:
prior to plating the falseworks, applying a material onto the falsework which is suitable for forming an alloy with the falsework which exhibits a lower melting temperature than that of the falsework.

78. Method, according to claim 69, wherein:
the falseworks are free-standing, having a proximal end mounted to the electronic component, and having a distal end, and further comprising:
prior to plating the at least one falsework, applying a masking material to the distal ends of the falseworks;
after plating the falseworks, removing the masking material; and
after removing the masking material, heating the plated falseworks.

79. Method, according to claim 69, wherein:
the falseworks are free-standing, having a proximal end mounted to the electronic component and a distal end, and a length therebetween and further comprising:
prior to plating the at least one falsework, applying a masking material to a one side of each falsework, along its length; after plating the falseworks, removing the masking material; and

after removing the masking material, heating the plated falseworks.

80. Method of tailoring the thickness of a plating, comprising:

disposing a member to be plated in a plating bath; and

creating a temperature gradient on the member, while plating the member.

81. Method, according to claim 80, further comprising:

creating the temperature gradient with a heat source selected from the group consisting of a resistive heat element, a thermocouple device, a Peltier-type device, an incandescent radiant heat source and a coherent light source.

82. A method of making two or more free-standing resilient contact structures, comprising:

forming a loop having two ends, a first of the two ends attached to a first terminal, a second of the two ends attached to a second terminal, a bight portion of the loop disposed approximately midway along the loop, a first leg portion extending from the first end to the bight portion, and a second leg extending from the second end to the bight portion; and

removing the bight portion.

83. Method, according to claim 82, further comprising:

overcoating the loop prior to removing the bight portion.

84. Method, according to claim 82, further comprising:

overcoating the loop after removing the bight portion.

85. Method, according to claim 82, further comprising:

prior to removing the bight portion, encapsulating the loop with a rigidizing material.

86. Method, according to claim 85, further comprising:

removing the bight portion by grinding.

87. Method, according to claim 86, further comprising:

after removing the bight portion, removing the encapsulant material.

88. A method for mounting a protuberant conductive contact to an electronic component, the method comprising the sequential steps of:

providing a wire having a continuous feed end,

bonding the feed end to the component,

forming, from the bonded feed end, a stem which protrudes from the component, said stem having a first stem end which is the bonded feed end,

severing the stem at a second stem end to define a skeleton,

depositing a metallic conductive material to envelop the skeleton and adjacent surface of the component.

89. The method as claimed in Claim 88, further comprising:

prior to the severing step, bonding the second stem end to the component.

90. A method for mounting a protuberant conductive contact to an electronic component, the method comprising the sequential steps of:

providing a wire having a continuous feed end,

bonding the feed end to the component,

forming, from the bonded feed end, a stem which protrudes from the component, said stem having a first stem end which is the bonded feed end,

severing the stem at a second stem end to define a skeleton,

depositing a metallic conductive material to jacket the skeleton and adjacent surface of the component.

91. The method as claimed in Claim 88, further comprising:

after the severing step, continuing sequentially the bonding step and the forming step and the severing step for a predetermined number of stems to comprise the skeleton.

92. The method as claimed in Claim 91, further comprising:

before each of the severing steps, each of the second stem ends is bonded to the component.

93. A method for mounting a protuberant conductive contact to a conductive terminal on an electronic component, the method comprising the sequential steps of:

providing a wire having a continuous feed end,

bonding the feed end to the terminal,

forming, from the bonded feed end, a stem which protrudes from the terminal, said stem having a first stem end which is the bonded feed end,

severing the stem at a second stem end to define a skeleton,

depositing a metallic conductive material to envelop the skeleton and adjacent surface of the terminal.

94. The method as claimed in Claim 93, further comprising:

before the severing step , bonding the second stem to the terminal.

95. The method as claimed in Claim 93, further comprising:

after the severing step, continuing sequentially the bonding step and the forming step and the severing step for a predetermined number of stems to comprise the skeleton.

96. The method as claimed in Claim 95, further comprising:

before each of the severing steps, each of the second stem ends is bonded to the terminal.

97. A method for mounting a protuberant conductive contact to a conductive terminal on an electronic component, the method comprising the sequential steps of:

providing a wire having a continuous feed end,

bonding the feed end to the terminal,

forming, from the bonded feed end, a stem which protrudes from the terminal, said stem having a first stem end which is the bonded feed end,

severing the stem at a second stem end to define a skeleton,

depositing a metallic conductive material to jacket the skeleton and adjacent surface of the terminal.

98. The method as claimed in Claim 97, further comprising:

before the severing step, bonding the second stem end to the terminal.

99. The method as claimed in Claim 97, further comprising:

after the severing step, continuing sequentially the bonding step and the forming step and the severing step for a predetermined number of stems to comprise the skeleton.

100. The method as claimed in Claim 99, further comprising:

before each of the severing steps, each of the second stem ends is bonded to the terminal.

101. A method for mounting a protuberant conductive contact to a conductive terminal on an electronic component, the method comprising the sequential steps of:

providing a wire having a continuous feed end and a length,

in a first bonding step, bonding the feed end to the terminal,

forming, from the bonded feed end, a stem which protrudes from the terminal, said stem having a first stem end which is the bonded feed end,

sequentially bonding intermediate portions along the length of the wire to the terminal, forming protruding stem segments between each pair of bonds, and

in a final bonding step, severing the wire to define a skeleton, and

depositing a metallic conductive material to envelop the skeleton and adjacent surface of the electronic component.

102. A method for mounting a protuberant conductive contact to a conductive terminal on an electronic component, the method comprising the sequential steps of:

providing a wire having a continuous feed end,

bonding the feed end to the terminal,

forming, from the bonded feed end, a stem which protrudes from the terminal and has a first stem end,

severing the stem at a second stem end to define a skeleton,

depositing a conductive material to envelop the skeleton and adjacent surface of the terminal,

further comprising:

performing the method on a plurality of the terminals and,

wherein:

the forming steps result in a plurality of free-standing protuberant stems,

the severing steps are performed on the respective stems all in a common plane.

103. The method as claimed in Claim 102, wherein:

the terminals are in different planes.

104. The method as claimed in Claim 93, performed on a plurality of terminals on at least one electronic component, wherein shapes of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contacts, and the severing steps are performed on all the stems in a common plane.

105. The method as claimed in Claim 88, wherein the cross-section of the wire is rectangular.

106. The method as claimed in Claim 88, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum,

rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys, and

at least one of the layers of the conductive material is a metal selected from a group consisting of nickel, phosphorous, boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

107. The method as claimed in Claim 101, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and their alloys ;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys ;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their alloys .

108. The method as claimed in Claim 90, further comprising:

after the severing step, continuing sequentially the bonding step and the forming step and the severing step for a predetermined number of stems to comprise the skeleton.

109. The method as claimed in Claim 108, further comprising:

before each of the severing steps, each of the second stem ends is intimately bonded to the component.

110. The method as claimed in Claim 90, further comprising:

before the severing step, bonding the second stem to the electronic component.

111. The method as claimed in Claim 90, further comprising:

after the severing step, continuing sequentially the bonding step and the forming step and the severing step for a predetermined number of stems to comprise the skeleton.

112. The method as claimed in Claim 90, further comprising:

before each of the severing ~~steps,~~ each of the second stem ends is bonded to the electronic component.

113. The method as claimed in Claim 94, further comprising:

before each of the severing steps, each of the second stem ends is bonded to the terminal.

114. The method as claimed in Claim 101, wherein the severing step occurs at substantially the same location as the first bonding step, and the protruding stem segments define a bounded spatial area.

115. The method as claimed in Claim 114, wherein the conductive material is solder.

116. The method as claimed in Claim 115, wherein the solder covers the skeleton and the bounded spatial area.

117. The method as claimed in Claim 116, further comprising:

disposing the electronic component on a heat sink, with the solder of the bounded spatial area in contact with the heat sink.

118. The method as claimed in Claim 116, further comprising:

disposing the electronic component on a substrate with the solder of the bounded spatial area in contact with the substrate.

119. The method as claimed in Claim 88, performed on a plurality of the terminals on the electronic component.

120. The method as claimed in Claim 90, performed on a plurality of the terminals on the electronic component.

121. The method as claimed in Claim 93, performed on a plurality of the terminals on the electronic component.

122. The method as claimed in Claim 101, performed on a plurality of the terminals on the electronic component.

123. The method as claimed in claim 93, performed on a plurality of wires on a plurality of the terminals on the electronic component.

124. The method as claimed in Claim 93, wherein:

the severing of the second end is performed by melting the wire.

125. The method as claimed in Claim 93, wherein:

the severing of the second end is performed by mechanical shearing.

126. The method as claimed in Claim 88, performed on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact.

127. The method as claimed in Claim 89, performed on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact.

128. The method as claimed in Claim 90, performed on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact.

129. The method as claimed in Claim 91, performed on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact.

130. The method as claimed in Claim 93, performed on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact.

131. The method as claimed in Claim 95, performed on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact.

132. The method as claimed in Claim 88, wherein:
the conductive material is provided with a multitude of microprotrusions on its surface.

133. The method as claimed in Claim 89, wherein:
the conductive material is provided with a multitude of microprotrusions on its surface.

134. The method as claimed in Claim 90, wherein:
the conductive material is provided with a multitude of microprotrusions on its surface.

135. The method as claimed in Claim 91, wherein:
the conductive material is provided with a multitude of microprotrusions on its surface.

136. The method as claimed in Claim 93, wherein:
the conductive material is provided with a multitude of microprotrusions on its surface.

137. The method as claimed in Claim 88, wherein:
the conductive material enveloping the skeleton and at least the adjacent surface of the component comprises a plurality of dissimilar layers.

138. The method as claimed in Claim 89, wherein:

the conductive material enveloping the skeleton and at least the adjacent surface of the component comprises a plurality of dissimilar layers.

139. The method as claimed in Claim 90, wherein:

the conductive material enveloping the skeleton and at least the adjacent surface of the component comprises a plurality of dissimilar layers.

140. The method as claimed in Claim 91, wherein:

the conductive material enveloping the skeleton and at least the adjacent surface of the component comprises a plurality of dissimilar layers.

141. The method as claimed in Claim 93, wherein:

the conductive material enveloping the skeleton and at least the adjacent surface of the component comprises a plurality of dissimilar layers.

142. The method as claimed in Claim 95, wherein:

the conductive material enveloping the skeleton and at least the adjacent surface of the component comprises a plurality of dissimilar layers.

143. The method as claimed in Claim 88, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another.

144. The method as claimed in Claim 89, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another.

145. The method as claimed in Claim 90, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another.

146. The method as claimed in Claim 91, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another.

147. The method as claimed in Claim 93, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another.

148. The method as claimed in Claim 95, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another.

149. The method as claimed in Claim 88, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another; and

wherein at least one of the layers comprising conductive material has a jagged topography in order to reduce contact resistance of the protuberant conductive contact when mated to a matching terminal.

150. The method as claimed in Claim 89, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another; and

wherein at least one of the layers comprising conductive material has a jagged topography in order to reduce contact resistance of the protuberant conductive contact when mated to a matching terminal.

151. The method as claimed in Claim 90, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another; and

wherein at least one of the layers comprising conductive material has a jagged topography in order to reduce contact resistance of the protuberant conductive contact when mated to a matching terminal.

152. The method as claimed in Claim 91, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another; and

wherein at least one of the layers comprising conductive material has a jagged topography in order to reduce contact resistance of the protuberant conductive contact when mated to a matching terminal.

153. The method as claimed in Claim 93, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another; and

wherein at least one of the layers comprising

conductive material has a jagged topography in order to reduce contact resistance of the protuberant conductive contact when mated to a matching terminal.

154. The method as claimed in Claim 95, further comprising:

performing the method on a plurality of the terminals, wherein a shape of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contact;

wherein the depositing step includes placement of a plurality of layers each differing from one another; and

wherein at least one of the layers comprising conductive material has a jagged topography in order to reduce contact resistance of the protuberant conductive contact when mated to a matching terminal.

155. The method as claimed in Claim 88, wherein:

the deposition is performed by a process of electrochemical plating in an ionic solution.

156. The method as claimed in Claim 89, wherein:

the deposition is performed by a process of electrochemical plating in an ionic solution.

157. The method as claimed in Claim 90, wherein:

the deposition is performed by a process of electrochemical plating in an ionic solution.

158. The method as claimed in Claim 91, wherein:

the deposition is performed by a process of electrochemical plating in an ionic solution.

159. The method as claimed in Claim 93, wherein:

the deposition is performed by a process of electrochemical plating in an ionic solution.

160. The method as claimed in Claim 95, wherein:

the deposition is performed by a process of electrochemical plating in an ionic solution.

161. Method, as set forth in claim 88, wherein:

the conductive material is deposited by an electroless plating process.

162. Method, as set forth in claim 90, wherein:

the conductive material is deposited by an electroless plating process.

163. Method, as set forth in claim 93, wherein:

the conductive material is deposited by an electroless plating process.

164. Method, as set forth in claim 97, wherein:

the conductive material is deposited by an electroless plating process.

165. Method, as set forth in claim 88, further comprising:

during deposition of the conductive material, causing a compressive internal stress in the conductive material.

166. Method, as set forth in claim 90, further comprising:

during deposition of the conductive material, causing a compressive internal stress in the conductive material.

167. Method, as set forth in claim 93, further comprising:

during deposition of the conductive material, causing a compressive internal stress in the conductive material.

168. Method, as set forth in claim 97, further comprising:

during deposition of the conductive material, causing a compressive internal stress in the conductive material.

169. A method for mounting a protuberant conductive contact to a conductive terminal on an electronic component, the method comprising the sequential steps of:

providing a wire having a continuous feed end,

bonding the feed end to the terminal,

forming, from the bonded feed end, a stem which protrudes from the terminal and has a first stem end,

severing the stem at a second stem end to define a skeleton,

depositing a conductive material to envelop the skeleton and adjacent surface of the terminal,

further comprising:

after the severing step, continuing sequentially the bonding step and the forming step and the severing step for a predetermined number of stems to comprise the skeleton,

further comprising:

performing the method on a plurality of the terminals and,

wherein:

the forming steps result in a plurality of free-standing protuberant stems,

the severing steps are performed on the respective stems all in a common plane.

170. The method as claimed in Claim 169, wherein:

the terminals are in different planes.

171. The method as claimed in Claim 95, performed on a plurality of terminals on at least one electronic component, wherein shapes of the skeleton and mechanical properties of the conductive material are organized collectively to impart resilience to the protuberant conductive contacts, and the severing steps are performed on all the stems in a common plane.

172. The method, as claimed in Claim 88, wherein:

the cross-sectional area of the wire is rectangular.

173. The method as claimed in Claim 90, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys, and

the conductive material is deposited as a plurality of layers, and at least one of the layers of the conductive material is a metal selected from a group consisting of nickel, phosphorous,
boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

174. The method as claimed in Claim 93, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys, and

the conductive material is deposited as a plurality of

layers, and at least one of the layers of the conductive material is a metal selected from a group consisting of nickel, phosphorous, boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

175. The method as claimed in Claim 97, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys, and

the conductive material is deposited as a plurality of layers, and at least one of the layers of the conductive material is a metal selected from a group consisting of nickel, phosphorous, boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

176. The method as claimed in Claim 88, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys.

177. The method as claimed in Claim 90, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys.

178. The method as claimed in Claim 93, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys.

179. The method as claimed in Claim 97, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys.

180. The method as claimed in Claim 101, wherein:

the wire is made of a metal selected from a group consisting of gold, silver, beryllium, copper, aluminum, rhodium, ruthenium, palladium, platinum, cadmium, tin, lead, indium, antimony, phosphorous, boron, nickel, magnesium, and their alloys.

181. The method as claimed in Claim 88, wherein:

the conductive material is deposited as a plurality of layers, and at least one of the layers of the conductive material is a metal selected from a group consisting of nickel, phosphorous, boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

182. The method as claimed in Claim 90, wherein:

the conductive material is deposited as a plurality of layers, and at least one of the layers of the conductive material is a metal selected from a group consisting of nickel,

phosphorous, boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

183. The method as claimed in Claim 93, wherein:

the conductive material is deposited as a plurality of layers, and at least one of the layers of the conductive material is a metal selected from a group consisting of nickel, phosphorous, boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

184. The method as claimed in Claim 97, wherein:

the conductive material is deposited as a plurality of layers of the conductive material is a metal selected from a group consisting of nickel, phosphorous, boron, cobalt, iron, chromium, copper, zinc, tungsten, tin, lead, bismuth, indium, cadmium, antimony, gold, silver, rhodium, palladium, ruthenium, and their alloys.

185. A method, according to claim 88, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and their alloys;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their

alloys .

186. The method as claimed in Claim 89, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and their alloys;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their alloys .

187. The method as claimed in Claim 90, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and their alloys;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their alloys .

188. The method as claimed in Claim 91, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and their alloys;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their alloys.

189. The method as claimed in Claim 93, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and alloys thereof;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and their alloys.

190. The method as claimed in Claim 95, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin,

indium and their alloys;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their alloys .

191. The method as claimed in Claim 97, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and their alloys;

the skeleton is coated with a first layer of the conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their alloys.

192. The method as claimed in Claim 101, further comprising:

performing the method on at least one terminal on an electronic component, wherein:

the wire is made primarily of a metal selected from a group consisting of gold, copper, aluminum, silver, lead, tin, indium and their alloys;

the skeleton is coated with a first layer of the

conductive material selected from a group consisting of nickel, cobalt, boron, phosphorous, copper, tungsten, titanium, chromium, and their alloys;

a top layer of the conductive material is solder selected from a group consisting of lead, tin, indium, bismuth, antimony, gold, silver, cadmium and alloys thereof and their alloys.

193. The method as claimed in Claim 88, wherein the conductive material is reactive with the wire stem; and

further comprising:

a barrier layer which is not reactive with the wire stem disposed between the wire stem and the conductive material.

194. The method as claimed in Claim 93, wherein the conductive material is reactive with the wire stem; and

further comprising:

a barrier layer which is not reactive with the wire stem disposed between the wire stem and the conductive material.

195. The method as claimed in Claim 95, wherein the conductive material is reactive with the wire stem; and

further comprising:

a barrier layer which is not reactive with the wire stem disposed between the wire stem and the conductive material.

196. The method as claimed in Claim 88, wherein:

each of two surfaces of the electronic component has at least one protuberant contact mounted thereto.

197. The method as claimed in Claim 90, wherein:

each of two surfaces of the electronic component has at least one protuberant contact mounted thereto.

198. The method as claimed in Claim 93, wherein:

each of two surfaces of the electronic component has at least one protuberant contact mounted thereto.

199. The method as claimed in Claim 97, wherein:

each of two surfaces of the electronic component has at least one protuberant contact mounted thereto.

200. The method as claimed in Claim 101, wherein:

each of two surfaces of the electronic component has at least one protuberant contact mounted thereto.

201. The method as claimed in Claim 88, wherein:

the wire stem is S-shaped.

202. The method as claimed in Claim 90, wherein:

the wire stem is S-shaped.

203. The method as claimed in Claim 93, wherein:

the wire stem is S-shaped.

204. The method as claimed in Claim 97, wherein:

the wire stem is S-shaped.

205. The method as claimed in Claim 101, wherein:

the wire stem is S-shaped.

206. Method of forming a resilient contact structure extending from a surface of an electronic component, comprising:

bonding an end of a wire to a terminal on a surface of an electronic component to extend initially in a first direction from the surface of the electronic component;

configuring the wire to have a shape including at least two bends;

severing the wire so that a severed end of the wire extends generally in the first direction; and

overcoating the wire and an area surrounding the bonded end of the wire with an electrically conductive, metallic material;

wherein:

the shape of the wire and the mechanical properties of the metallic material cooperate to impart resiliency to a resulting resilient contact structure comprising the wire and the metallic material.

207. Method for manufacturing a conductive contact on an electronic component, comprising:

bonding an end of a wire to a first area on a surface of an electronic component;

shaping the wire to extend as a wire stem from the surface of the electronic component;

severing the wire stem so that it has a free end and a length; and

depositing a conductive coating having at least one layer on the wire stem;

wherein:

the conductive coating covers at least a portion of the wire stem, said portion of the wire stem commencing at the bonded end of the wire stem and continuing along its length; and

the conductive coating covers a second area on the surface of the electronic component, said second area being larger than and encompassing the first area.

208. Method, according to claim 207, wherein:

the conductive coating covers the entire length of the wire stem.

209. Method, according to claim 207, wherein:

at least one layer of the conductive coating is deposited along the entire length of the wire stem.

210. Method, according to claim 207, wherein:

the conductive coating covers only a portion of the length of the wire stem.

211. Method, according to claim 207, further comprising:

supplying the wire from a spool of wire.

212. Method, according to claim 207, wherein:

the first area is a conductive terminal disposed on the surface of the electronic component.

213. Method, according to claim 207, wherein:

the first area is a first portion of a conductive terminal; and

the second area is a second portion of the conductive terminal.

214. Method, according to claim 207, further comprising:

forming a plurality of wire stems at a plurality of first and second areas on a conductive layer of the electronic component.

215. Method, according to claim 207, wherein:

the wire stem is shaped in two-dimensions to define a skeleton of a resulting contact.

216. Method, according to claim 207, wherein:

the wire stem is shaped in three-dimensions to define a skeleton of a resulting contact.

217. Method, according to claim 207, wherein:

the wire stem is shaped to have an S-shape.

218. Method, according to claim 207, wherein:

the wire stem is shaped to extend normal to the surface of the electronic component.

219. Method, according to claim 207, wherein:

the wire stem is shaped to extend at an angle to the surface of the electronic component.

220. Method, according to claim 207, wherein:

the electronic component is an interconnection substrate.

221. Method, according to claim 207, wherein:

the electronic component is a semiconductor device.

222. Method, according to claim 221, wherein:

the semiconductor device is a silicon device.

223. Method, according to claim 221, wherein:

the semiconductor device is a gallium arsenide device.

224. Method, according to claim 207, wherein:

the electronic component is an interconnect socket.

225. Method, according to claim 207, wherein:
the electronic component is a test socket.

226. Method, according to claim 207, wherein:
the electronic component is a semiconductor wafer.

227. Method, according to claim 207, wherein:
the electronic component is a ceramic semiconductor package.

228. Method, according to claim 207, wherein:
the electronic component is a plastic semiconductor package.

229. Method, according to claim 207, wherein:
the wire stem is bonded to the surface of the electronic component using ultrasonic bonding equipment.

230. Method, according to claim 207, wherein:
the wire stem is bonded to the surface of the electronic component using thermosonic bonding equipment.

231. Method, according to claim 207, wherein:
the wire stem is bonded to the surface of the electronic component using thermocompression bonding equipment.

232. Method, according to claim 207, wherein wirebonding equipment is used to bond the end of the wire stem to the surface of the electronic component, and further comprising:
during shaping, controlling all aspects of geometric

characteristics of the wire stem with a specific set of commands entered into an electronic control system of the wirebonding equipment.

233. Method, according to claim 207, wherein:

automated wirebonding equipment, controllable by a software algorithm, is used to shape the wire stem and to determine the coordinate of a tip of its free end.

234. Method, according to claim 207, further comprising:

shaping the wire stem with automated equipment controlled by a control system, according to a set of specified parameters.

235. Method, according to claim 207, wherein:

the wire is severed by generating a spark.

236. Method, according to claim 207, wherein:

the wire is severed using a flame-off technique.

237. Method, according to claim 207, further comprising:

in same step as severing the wire stem, forming a ball at a tip of the free end of the wire stem.

238. Method, according to claim 207, wherein:

the conductive coating is deposited by an electrochemical process.

239. Method, according to claim 207, wherein:

the conductive coating is deposited by an electrolytic plating process.

240. Method, according to claim 207, wherein:

the conductive coating is deposited by an electroless plating process.

241. Method, according to claim 207, wherein:

the conductive coating is deposited by a process selected from the group consisting of physical vapor deposition and chemical vapor deposition.

242. Method, according to claim 207, wherein:

the conductive coating is deposited by a process that involves the decomposition of gaseous, liquid or solid precursors.

243. Method, according to claim 207, further comprising:

providing the conductive coating with a plurality of local protrusions.

244. Method, according to claim 243, further comprising:

reducing a contact resistance between the conductive contact and an electronic device to which the conductive contact is mated with the local protrusions.

245. Method, according to claim 243, wherein:

the local protrusions are provided by dendritic growth of an electroplated deposit.

246. Method, according to claim 243, wherein:

the local protrusions are provided by incorporation of foreign particulates into the conductive coating during its deposition onto the wire stem.

247. Method, according to claim 243, wherein:

a uniform first layer of the conductive coating is

deposited onto the wire stem; and

further comprising forming the local protrusions in a subsequently deposited layer of the conductive coating.

248. Method, according to claim 247, wherein:

the first layer is selected to be a material suitable for imparting resilient properties to the conductive contact; and

the subsequently deposited layer is selected to be a material that reduces the contact resistance between the conductive contact and the electronic device to which the conductive contact is mated.

249. Method, according to claim 207, wherein:

an outer one of a plurality of layers deposited on the wire stem includes a conductive material is selected from the group consisting of gold, silver, elements of the platinum group, and their alloys.

250. Method, according to claim 207, wherein:

the wire stem comprises a material selected from the group consisting of gold, aluminum, copper, beryllium, cadmium, silicon, magnesium, silver and platinum, and their alloys.

251. Method, according to claim 207, wherein:

the wire stem has a diameter between 0.0005 and 0.005 inches.

252. Method, according to claim 251, wherein:

the wire stem has a diameter between 0.0007 and 0.003 inches

253. Method, according to claim 207, wherein:

the conductive coating comprises a material selected from the group consisting of nickel, copper, cobalt, iron, and their alloys.

254. Method, according to claim 207, wherein:
the coating has a tensile strength in excess of 80,000 pounds per square inch.

255. Method, according to claim 207, further comprising:
during deposition of the conductive coating, causing a compressive internal stressing in the conductive coating.

256. Method, according to claim 207, wherein:
the nickel has a thickness between 0.00005 and 0.007 inches.

257. Method, according to claim 256, wherein:
the nickel has a thickness between 0.00010 and 0.003 inches.

258. Method, according to claim 207, wherein:
the conductive coating is deposited as two or more layers, at least the outer layer of the two or more layers being a conductive material.

259. Method, according to claim 258, wherein:
a first layer, deposited onto the wire stem, is nickel; and
a second layer deposited over the first layer is a material selected from the group consisting of gold, silver, elements of the platinum group, and their alloys.

260. Method, according to claim 258, wherein:

the two or more layers are selected to tailor the mechanical characteristics of the protuberant contact.

261. Method, according to claim 207, wherein:

the first area includes a layer of material selected from the group consisting of gold and aluminum.

262. Method, according to claim 207, wherein:

the first area and the second area are portions of a conductive layer previously applied to the surface of the electronic component.

263. Method, according to claim 262, further comprising:

after bonding, removing the conductive layer from the electronic component, selectively, ~~in~~ all but the first and second area.

264. Method, according to claim 207, further comprising:

establishing a predetermined resiliency for the contact based on a shape of the wire stem and characteristics of the conductive coating selected from the group consisting of thickness, yield strength, and elastic modulus.

265. Method, according to claim 207, wherein:

the wire stem comprises a material having a first strength; and

the conductive coating comprises a material having a second strength which is greater than the strength of the first material.

266. Method, according to claim 207, wherein:

the conductive contact has controlled characteristics selected from the group consisting of physical properties,

metallurgical properties, mechanical properties, bulk and surface.

267. Method, according to claim 207, wherein:

the raised conductive contact is shaped as a pin-shaped contact; and

the electronic component is a pin grid array package.

268. Method, according to claim 267, wherein:

the pin grid array package is a ceramic pin grid array package.

269. Method, according to claim 267, wherein:

the pin grid array package is a plastic pin grid array package.

270. Method, according to claim 207, further comprising:

bonding, shaping and severing a plurality of wire stems, a first portion of the wire stems originating from a first level of the electronic component, a second portion of the wire stems originating from a second level of the electronic component, said first level and said second level being non-coplanar with one another;

wherein:

the free ends of said plurality of wire stems are severed to be substantially coplanar with one another.

271. Method, according to claim 270, wherein:

the free ends of the wire stems are severed to extend to a plane parallel to at least one of the first and second levels of the electronic component.

272. Method, according to claim 207, further comprising:

bonding, shaping and severing a plurality of wire stems, a first portion of the wire stems originating from a first electronic component, a second portion of the wire stems originating from a second electronic component;

wherein:

the free ends of said plurality of wire stems are severed to be substantially coplanar with one another.

273. Method, according to claim 272, wherein:

the free ends of the wire stems are severed to extend to a plane parallel to at least one of the first and second electronic components.

274. Method, according to claim 207, further comprising:

bonding, shaping and severing a plurality of wire stems originating from the electronic component, a first portion of the wire stems terminating on a first electronic device, a second portion of the wire stems terminating on a second electronic device.

275. Method, according to claim 207, further comprising:

bonding, shaping and severing a plurality of wire stems;

wherein:

a first portion of the wire stems are severed to terminate at a first level above the surface of the electronic component; and

a second portion of the wire stems are severed to terminate at a second level above the surface of the electronic component, said first level and said second level being non-coplanar.

276. Method, according to claim 207, further comprising:

bonding, shaping and severing a plurality of wire stems originating from at least two electronic components, each of a portion of the wire stems extending from a corresponding one of the at least two electronic components.

277. Method, according to claim 276, further comprising:

interconnecting the first and second electronic components.

278. Method, according to claim 276, wherein:

one of the first and second electronic components is a capacitor.

279. Method, according to claim 276, wherein:

one of the first and second electronic components is a resistor.

280. Method, according to claim 207, further comprising:

bonding, shaping and severing a plurality of wire stems;

wherein:

a first portion of the wire stems are severed to terminate at a first level above the surface of the electronic component; and

a second portion of the wire stems are severed to terminate at a second level above the surface of the electronic component, said first level and said second level being non-coplanar; and

further comprising:

terminating the first portion of the wire stems on an interconnection substrate; and

terminating the second portion of the wire stems on an electronic device disposed between the interconnection substrate

and the electronic component.

281. Method, according to claim 280, wherein:

the electronic component is a bare, unpackaged semiconductor device.

282. Method, according to claim 280, wherein:

the electronic device is a capacitor.

283. Method, according to claim 280, wherein:

the electronic component is a bare, unpackaged semiconductor device; and

the electronic device is a capacitor.

284. Method, according to claim 207, wherein:

the conductive coating comprises solder, and the conductive contact is a tower-like solder contact extending from the surface of the electronic component.

285. Method, according to claim 284, further comprising:

prior to depositing the conductive coating on the wire stem, depositing a barrier layer on the wire stem, said barrier layer being a material selected to prevent a reaction between the conductive coating and the wire stem.

286. Method, according to claim 285, wherein:

the wire stem is gold; and

the barrier layer is a material selected from the group consisting of nickel, copper, cobalt, iron, or their alloys.

287. Method, according to claim 207, further comprising:

establishing the soldering characteristics of the

electronic substrate by selection of a material composition of the conductive coating.

288. Method, according to claim 207, wherein:

establishing the long term effects from interaction of the raised conductive contact with solder. by selection of a material composition of the conductive coating.

289. Method, according to claim 207, wherein:

the wire stem has a diameter between 0.0005 and 0.005 inches; and

further comprising:

prior to depositing the solder, coating the wire stem with nickel having a thickness between 0.00005 and 0.007 inches.

290. Method, according to claim 289, wherein:

the wire stem has a diameter between 0.0007 and 0.003 inches; and

the nickel has a thickness between 0.00010 and 0.003 inches.

291. Method, according to claim 207, further comprising:

shaping the wire stem in a form of a loop, said loop originating and terminating in a selected second area on the surface of the electronic component.

292. Method, according to claim 207, further comprising:

shaping the wire stem in a form of a loop, said loop originating on a conductive terminal of the electronic component, said loop terminating on a sacrificial element.

293. Method, according to claim 292, further comprising:

after bonding the free end of the wire stem to the

sacrificial conductor, removing the sacrificial element.

294. Method, according to claim 293, wherein:

the sacrificial element is removed after depositing the conductive coating on the wire stem.

295. Method, according to claim 293, wherein:

the sacrificial element is removed before depositing the conductive coating on the wire stem.

296. Method, according to claim 207, further comprising:

shaping the wire stem in a form of a loop, said loop originating on a sacrificial element, said loop terminating on a conductive terminal of the electronic component.

297. Method, according to claim 207, further comprising:

shaping the wire stem in a form of a loop, said loop originating in the second area on the surface of the electronic component, said loop terminating in a third area distinct from the second area.

298. Method, according to claim 207, further comprising:

shaping the wire stem in a form of a loop, said loop originating in a third area on the surface of the electronic component, said third area distinct from said second area, and said loop terminating in the second area.

299. Method, according to claim 207, further comprising:

shaping a first length of the wire stem into a first loop, said first loop originating and terminating on a conductive terminal disposed on the surface of the electronic

component;

severing the first length of the wire stem;

shaping a second length of the wire stem into a second loop, said second loop originating and terminating on the conductive terminal and being parallel to the first loop;

severing the second length of the wire; and

depositing a common conductive coating of solder on the first and second loops and onto the conductive terminal to form a controlled aspect ratio column of solder disposed on the conductive terminal of the electronic component; and

prior to depositing the common conductive coating of solder, coating the two loops with a barrier layer;

wherein:

the wire is gold;

the solder is an alloy of lead and tin; and

the barrier layer is a nickel alloy having a thickness on the wires sufficient to deter a reaction between the solder of the conductive coating and the gold of the wire.

300. Method, according to claim 207, further comprising:

prior to severing the wire, bonding an intermediate portion of the wire to the electronic component, thereby forming a skeleton on the surface of the electronic component.

301. Method, according to claim 300, wherein:

the intermediate portion is bonded to the second area of the electronic component.

302. Method, according to claim 300, further comprising:

after bonding the intermediate portion of the wire to the electronic component, coating the skeleton with a solder

mass.

303. Method, according to claim 302, further comprising:

prior to coating the skeleton with the solder mass, coating the skeleton with a barrier layer.

304. Method, according to claim 300, further comprising:

after bonding the intermediate portion of the wire to the electronic component, severing the wire to have a subsequent end for bonding as a subsequent skeleton on the surface of the electronic component.

305. Method, according to claim 300, wherein:

a plurality of skeletons are formed on a common second area of the electronic component.

306. Method, according to claim 305, wherein:

the common second area is a terminal.

307. Method, according to claim 305, wherein:

the plurality of skeletons are overcoated in a common depositing step.

308. Method, according to claim 300, further comprising:

after bonding the intermediate portion of the wire to the electronic component, without severing the wire, continuing to bond subsequent intermediate portions of the wire, without severing, to form a sequence of skeletons on the surface of the electronic component.

309. Method, according to claim 308, further comprising:

bonding and severing a last one of the skeletons adjacent the first area.

310. Method, according to claim 308, wherein:

the sequence of skeletons defines an enclosed area on the surface of the electronic component.

311. Method, according to claim 300, further comprising:

depositing solder as the conductive coating in a manner that the solder fills the enclosed area.

312. Method, according to claim 301, further comprising:

bringing the enclosed, solder-filled area into contact with an electronic device selected from the group consisting of heat sinks and substrates.

313. Method, according to claim 207, further comprising:

repeating the steps of bonding, shaping and severing for a plurality of wire stems, wherein the conductive coating is deposited as a common coating onto the plurality of wire stems.

314. Method, according to claim 313, wherein:

the plurality of wire stems are arranged in an array pattern on the surface of the electronic component.

315. Method, according to claim 207, further comprising:

bonding the second end of the wire stem to the first area of the electronic component to form a loop; and

further shaping the loop to extend from the electronic component in three-dimensions.

316. Method for manufacturing electrical contacts on a surface of an electronic component, comprising, for each raised

electrical contact:

bonding a one end of a wire to a first area on the surface of the electronic component, said surface of the electronic component disposed in a plane defined by an "x" axis and a "y" axis orthogonal to the "x" axis;

with the one end of the wire bonded to the area on the surface of the electronic component, extending the wire in a "z" axis mutually orthogonal to the "x" and "y" axes, and in at least one of the "x" or "y" directions;

after extending the wire, severing the wire so that it has a length and a free end opposite the one end;

while extending the wire, shaping the wire to have at least one U-shaped bend along its length; and

after extending and shaping the wire, depositing a first electrically conductive, metallic material to cover a second area on the surface of the substrate which is greater than and which subsumes the first area to which the one end of the wire is bonded and to cover at least a portion of the length of the wire, said portion of the wire extending from the one end of the wire along the length of the wire towards the free end of the wire.

317. Method, according to claim 316, further comprising:

depositing at least two coatings on the wire.

318. Method of connecting a first electronic component to a second electronic component, comprising:

providing a third electronic component between the first and the second electronic components, said third electronic component having a first plurality of resilient contact structures extending from a first surface thereof for contacting a corresponding plurality of contact points on a face of the first electronic component, said third electronic

component having a second plurality of resilient contact structures extending from a second surface thereof for contacting a corresponding plurality of contact points on a face of the second electronic component; and

within the third electronic component, making a connection between the first plurality of resilient contact structures and the second plurality of resilient contact structures.

319. Method, according to claim 318, wherein:

the first electronic component is a semiconductor package.

320. Method, according to claim 318, wherein:

the first electronic component is an unpackaged semiconductor die.

321. Method, according to claim 318, wherein:

the second electronic component is a printed circuit board.

322. Method, according to claim 318, wherein:

the third electronic component provides for demountable interconnection between the first and second electronic components.

323. Method of making a temporary connection between a first electronic component and a second electronic component, and subsequently making a permanent connection between the first electronic component and a third electronic component, comprising:

mounting a plurality of resilient contact structures to a surface of the first electronic component;

urging the first electronic component against the

second electronic component to effect a temporary connection between the first electronic component and the second electronic component;

removing the second electronic component; and

mounting the first electronic component to the third electronic component.

324. Method, according to claim 323, further comprising:

while the first and second electronic components are temporarily connected, performing at least one function selected from the group consisting of burn-in and testing of the first electronic component.

325. Interposer, comprising:

a dielectric substrate having a first surface and a second surface opposite the first surface, a first plurality of conductive areas on the first surface, a second plurality of conductive areas on the second surface, each of the first plurality of conductive areas electrically connected to a corresponding one of the second conductive areas;

a first plurality of resilient contact structures extending from the first conductive areas; and

a second plurality of contact structures extending from the first conductive areas.

326. Interposer, according to claim 325, wherein:

the first plurality of resilient contact structures are compliant contact structures.

327. Interposer, according to claim 326, further comprising:

at least one standoff element fabricated on the first surface, to limit deflection of the first plurality of resilient

contact structures.

328. Interposer structure, according to claim 325, wherein:

the electrical connections between the first plurality of conductive areas and the second plurality of conductive areas is plated through holes.

329. Interposer, according to claim 325, wherein:

the second plurality of contact structures are resilient contact structures.

330. Interposer, according to claim 329, wherein:

the second plurality of contact structures are non-resilient contact structures.

331. Interposer, according to claim 325, wherein:

at least one of either of the first plurality of resilient contact structures and the second plurality of contact structures comprises at least two contact structures.

332. Interposer, comprising:

a dielectric substrate having a first surface and a second surface opposite the first surface, and having a plurality of conductive areas on the first surface;

a plurality of resilient contact structures mounted to the plurality of conductive areas, and having a first portion extending beyond the first surface of the dielectric substrate for making a connection to a first electronic component, and having a second portion contiguous with the first portion and extending beyond the second surface of the dielectric substrate for making an interconnect to a second electronic component.

333. Interposer, according to claim 332, wherein:

the second portions of the plurality of resilient contact structures extend through holes in the substrate.

334. Interposer, according to claim 325, wherein:

the second plurality of contact structures are resilient contact structures; and

further comprising:

conductive traces on both surfaces of the dielectric substrate.

335. Interposer, according to claim 325, further comprising:

standoff elements on the first side of the substrate

336. Interposer, according to claim 325, further comprising:

a plurality of conductive areas on the first side of the substrate;

wherein:

the first plurality of resilient contact structures extend from the conductive areas.

337. Interposer, according to claim 336, further comprising:

a plurality of holes extending through the substrate; and

wherein:

the second contact structures extend from the conductive areas through the plurality of holes, to the second side of the substrate.

338. Interposer, according to claim 325, wherein:

the first plurality of resilient contact structures are arranged in pairs.

339. Interposer, according to claim 325, further comprising:

a plurality of conductive areas on the first side of the substrate; and

a plurality of holes extending through the substrate;

wherein:

the first plurality of resilient contact structures extend through the plurality of holes beyond the first side of the substrate to beyond the second side of the substrate; and

the first plurality of resilient contact structures are electrically connected to the conductive areas.

340. Interposer, comprising:

a substrate having a plurality of holes extending from a first surface of the substrate to a second surface of the substrate;

a plurality of contact structures, each contact structure disposed within a corresponding hole; and

means for supporting the contact structures within the holes.

341. Interposer, according to claim 340, wherein:

the contact structures are resilient contact structures.

342. Interposer, according to claim 340, wherein:

the means for supporting is an elastomeric material.

343. Interposer, according to claim 342, wherein:

at least a portion of the elastomeric material is electrically conductive.

344. Interposer, according to claim 340, further comprising:

a metallic surface within each hole; and

wherein:

the means for supporting is solder.

345. Interposer, according to claim 340, wherein:

the substrate is metallic, and is overcoated with an insulating material.

346. Method of manufacturing shaped contact structures, comprising:

mounting a plurality of free-standing wire stems to a substrate with a first mechanism; and

shaping the wire stems with a second mechanism which is external to the first mechanism.

347. Semiconductor package, comprising:

a first insulating layer;

a first conductive layer disposed on a first surface of the first insulating layer and patterned to have a first plurality of conductive traces;

a second insulating layer;

a second conductive layer disposed on a first surface of the second insulating layer and patterned to have a second plurality of conductive traces;

the first conductive layer being in contact with the second insulating layer;

the second conductive and insulating layers are arranged and disposed so that outer portions of the first plurality of conductive traces are exposed;

a first plurality of electrical contact structures mounted to outer portions of the first plurality of conductive traces; and

a second plurality of electrical contact structures mounted to the second plurality of conductive traces.

348. Semiconductor package, according to claim 347, wherein:

the first plurality of electrical contact structures extend to a plane; and

the second plurality of electrical contact structures extend to the plane.

349. Semiconductor package, according to claim 347, wherein:

the first plurality of electrical contact structures are resilient contact structures; and

the second plurality of electrical contact structures are resilient contact structures.

350. Semiconductor package, according to claim 347, further comprising:

means for receiving a semiconductor device;

wherein:

the second conductive and insulating layers are arranged and disposed so that inner portions of the first plurality of conductive traces are exposed for connecting to a semiconductor device; and

further comprising:

means for connecting the semiconductor device to the

exposed inner portions of the first plurality of conductive traces; and

means for connecting the semiconductor device to the second plurality of conductive traces.

a first plurality of electrical contact structures mounted to outer portions of the first plurality of conductive traces; and

a second plurality of electrical contact structures mounted to the second plurality of conductive traces.

351. Semiconductor device, comprising:

a semiconductor die having a front surface and a back surface;

a plurality of free-standing interconnect structures mounted to the front surface of the semiconductor die; and

a plurality of free-standing heat-dissipating structures mounted to the back surface of the semiconductor die.

352. Semiconductor device, according to claim 351, wherein:

the interconnect structures are resilient contact structures.

353. Semiconductor device, according to claim 351, wherein:

the interconnect structures are compliant contact structures.

354. Semiconductor device, according to claim 351, wherein:

the free-standing heat-dissipating structures are wires mounted to the back surface of the semiconductor die.

355. Semiconductor device, according to claim 351, wherein:

the free-standing interconnect structures are of a first material; and

the free-standing heat-dissipating structures are of a second material which is different from the first material.

356. Semiconductor device, according to claim 355, wherein:

the free-standing interconnect structures and the free-standing heat-dissipating structures are overcoated with a common material.

357. Semiconductor device, according to claim 351, further comprising:

a layer of a metallic material disposed between the free-standing heat-dissipating structures and the back surface of the semiconductor die.

the interconnect structures are resilient contact structures.

358. Semiconductor device, comprising:

a semiconductor die having a front surface and a back surface; and

a plurality of free-standing resilient contact structures mounted to the front surface of the semiconductor die.

359. Semiconductor device, according to claim 358, further comprising:

conductive pads disposed on the front surface of the semiconductor die; and

wherein:

one contact structure is mounted to each conductive pad.

360. Semiconductor device, according to claim 358, wherein the resilient contact structures each comprise:

a wire stem bonded at one end to the front surface of the semiconductor die and configured to have a springable shape; and

an overcoat material applied over the wire stem and over a portion of the front surface of the semiconductor die.

361. Semiconductor device, according to claim 358, wherein:

the resilient contact structures are compliant.

362. Method of assembling an electronic assembly, comprising:

preparing a first wiring substrate with a first plurality of semiconductor devices mounted to the first wiring substrate;

preparing a second wiring substrate with a second plurality of semiconductor devices mounted to the second wiring substrate;

the second wiring substrate has electrical contact structures mounted thereto for connecting to contact pads on the first wiring substrate; and

the first and second wiring substrates are stacked, one atop the other, and are interconnected to one another with the electrical contact structures.

363. Method, according to claim 362, wherein:

the first wiring substrate has two sides;

the second wiring substrate has two sides;

the first plurality of semiconductor devices are mounted to both sides of the first wiring substrate; and

the second plurality of semiconductor devices are mounted to both sides of the second wiring substrate.

364. Method, according to claim 362, further comprising:

a first plurality of resilient contact structures electrically interconnecting the first plurality of semiconductor devices to the first wiring substrate; and

a second plurality of resilient contact structures electrically interconnecting the second plurality of semiconductor devices to the second wiring substrate.

365. Method of mounting a free-standing contact structure to an electronic component, comprising:

providing a pierceable mass of conductive material on a terminal on an electronic component;

inserting an end of a wire into the conductive material;

severing the wire to be free-standing; and

overcoating the wire and the mass with a conductive, metallic material.

366. Method, according to claim 365, wherein:

the mass of conductive material is solder.

367. Method, according to claim 365, wherein:

the mass of conductive material is conductive epoxy.

368. Method, according to claim 365, wherein:

the overcoating is performed by plating.

369. Method of performing wirebonding, comprising:

bonding a bond wire to a terminal with a capillary;

playing the bond wire out of the capillary;

severing the bond wire with a discharge from an electrode; and

while severing the bond wire, illuminating at least

one of the electrode and the bond wire with ultraviolet light.

370. Method, according to claim 369, further comprising:
prior to severing the bond wire, configuring the bond wire to have a springable shape.

371. Method of forming a ball at an end of a wirebond wire, comprising:
causing an electrical discharge between an electrode and a bond wire; and
while causing the electrical discharge, illuminating at least one of the electrode and the bond wire with ultraviolet light.

372. Method of performing wirebonding, comprising:
bonding a bond wire to a terminal with a capillary;
playing the bond wire out of the capillary;
while playing the bond wire out of the capillary, providing a gas flow within the capillary.

373. Method, according to claim 372, further comprising:
while playing the bond wire out of the capillary, configuring the bond wire to have a springable shape.

374. Method of making engineering changes in an interposer having a first plurality of contact structures extending from a first side of a substrate and a second plurality of contact structures extending from a second side of the substrate, comprising:
providing a plurality of conductive traces on at least one side of the substrate; and
routing the conductive traces so as to interconnect selected ones of the first plurality of contact structures with

selected ones of the second plurality of contact structures.